ner's method gives, as we have seen, a line on which the ship is, and in doing so it gives us all the information which any one sight can yield. But if we possess some other information, such as a knowledge of the true latitude, the position becomes completely determinate; each condition gives a locus, and the intersection of the two loci gives a point. By introducing this foreign element into the calculation of the original sight, we may obtain at once the definite information that the ship is in a certain latitude and longitude, and we may do so by a single calculation. This is the practice of ninety-nine navigators out of a hundred, but it is a practice much to be deprecated. It makes the sailor imagine that a knowledge of the latitude, got either by dead reckoning or by taking a meridian altitude, is necessary in order that he may get any information at all out of a single observation of altitude and time. If he trusts to obtaining this knowledge by dead reckoning he is likely enough to estimate the latitude wrongly, and by so doing to vitiate the whole calculation. If he trusts to observing the meridian altitude, he is often disappointed by the sun's being clouded over at noon. Many a captain has lost his ship through not knowing how to avail himself (by Sumner's method) of the information which he might have derived from a short glimpse of the sun on a cloudy day. Another danger in the ordinary practice is that it tempts the navigator not to work out each sight as soon as it has been taken, for he must often wait until he is able to obtain the other information, without which he is helpless. But when Sumner's method is used, every sight tells its own tale, and there is no reason whatever why it should not tell it at once.

The limits of a review do not admit of our describing the manner in which Sir William Thomson has contrived to facilitate Sumner's method. A full explanation of how it has been done will be found in the preface to his book. At first sight it appeared that, in order that tables might be of any use, they would require to contain the solutions of 157,464,000,000 spherical triangles, to calculate which, at the rate of 1,000 per day, would take 400,000 years. This did not seem promising, but Sir William Thomson was not dismayed. He soon saw that by dividing the problem into the solution of two right-angled spherical triangles he could give all the required information in a table containing the solutions of only 8,100 triangles. These 8,100 calculations have been made under the superintendence of Mr. E. Roberts, of the *Nautical Almanac* Office, and the results are tabulated in the volume before us. Full instructions for their use are appended, along with some auxiliary tables which add greatly to the completeness of the work. Not to go into details, we may say that by an admirable application of the *second* of the two plans given above for drawing the Sumner line, the author has so shortened the time required to reduce an observation, as to convert what was formerly an objection to Sumner's method into a positive recommendation, and so has deprived sailors of their only possible excuse for not adopting it universally.

Such a general adoption, besides its direct benefits in increasing the safety of ships and men at sea, could not fail to have a great indirect effect for good in assisting the sailor to a clear perception of the fundamental principles underlying the processes which he daily employs, too often, we fear, in blind routine. A seaman using Sumner's method can hardly help understanding what he is about, but he may work for a lifetime with the hackneyed formulæ in common use, and have no notion from first to last of why he should add a quantity rather than subtract it, or indeed of why he should deal with it at all. We have heard of a captain who used a *plus* instead of a *minus* sign for two or three weeks, and first suspected that something must be wrong when he found himself on a coral reef hundreds of miles off his supposed course. When a landsman with a smattering of mathematics goes to sea and is admitted to the privacy of the chart-room, his wonder is, not so much that some ships are lost, as that any ships escape.

It is not the masters or the mates that are chiefly to blame for this state of things. Before they enter the service their utmost immediate ambition is to get the needed certificate of competency from the Board of Trade, and they naturally study only to pass the required examination. Then afterwards their professional life is not exactly that calm repose which conduces to progress in a scientific knowledge of their art. There are no doubt exceptional men whose love of their profession is so strong as to override the barriers of circumstance. Such men deserve all praise, but we can hardly blame the rest. For a remedy we must look not to the individual officer but to the authorities who have the making of him. It is strange that the Board of Trade should not have seen it to be a duty to let no British seaman obtain its certificate without showing himself to be thoroughly acquainted with Sumner's method. Until the Board does this it will be mainly, we might say almost wholly, responsible for the prevailing neglect of this method.

The position of the nautical reformer seems to us to be anything but enviable. His virtue is perhaps its own reward, certainly he seldom meets with any other. The Board of Trade and the Admiralty will have none of him, and he cannot make much way against the conservatism bred of ignorance that he finds elsewhere. It is still fresh in the memory of every one how Mr. Plimsoll at last compelled a reluctant government to take legislative action on behalf of seamen. Unfortunately, Sir William Thomson must confine himself to milder methods: he has no opportunity of shaking his fist in the face of a prime minister.

OUR BOOK SHELF

Botanical Tables for the Use of Students. Compiled by Edward B. Aveling, B.Sc. Second Edition. (London: Hamilton, Adams, and Co.).

ANY attempt to compress the facts of nature within the arbitrary limits of a defined tabular statement must necessarily be misleading from a scientific, that is, from a philogenetic, point of view. Classificatory tables have nevertheless their use to the student, in aiding his memory by bringing a large number of facts within a small compass. Dr. Aveling is careful to disavow any independent value for his tables, and frankly states that they will not only be useless, but positively injurious, if allowed in any way to be a substitute for practical field-work. With these limitations the tables may be recommended as probably as good, or nearly so, as any that could be drawn up. They have been compiled carefully, and on the whole successfully. Defects can no doubt be pointed out. Thus the description of certain inflorescences as "centripetal arranged centrifugally" requires a foot-note to explain its

meaning; the class *Gymnospermæ* is given on one page as of superior value to *Incompletæ*, on another as included within it; and it is difficult to understand how the terms "loculicidal" and "septicidal" can be applied with propriety to a mono-carpellary capsule like that of the primrose. The statement that "the tables on classification have been compiled from Dr. Hooker's 'Student's Flora of the British Islands'" is rather misleading, when we find, on p. 14, the Gamopetalous orders with inferior ovary included in "Calycifloræ." But defects of this sort are incidental to any attempt of the kind. Dr. Aveling may be congratulated on the success of his effort, if it be not of a very high order.

Vergleichende Untersuchungen über den Bau der Vegetationsorgane der Monocotyledonen. Von Dr. P. Falkenberg. Mit drei Tafeln. (Stuttgart: F. Enke, 1876.)

OUR knowledge of the anatomical structure of the stem of Monocotyledons has hitherto been pretty much confined to that of palms, and has been founded to a great extent on the researches of Mohl and Mirbel. It has hence been assumed, perhaps somewhat rashly, that the type of structure is far more uniform in the stem of Monocotyledons than of Dicotyledons. For the purpose of investigating this point Dr. Falkenberg has submitted to very careful examination the stem of one or more species belonging to as many as seventeen orders or sub-orders of Monocotyledons, and shows that our previous conceptions must be modified in several respects. The stem of Monocotyledons, he states, is divided into an inner central cylinder and an outer cortical layer by a separating sheath which is developed in some cases from the internal, in other cases from the external tissue. As regards the course of the fibrovascular bundles in the central cylinder, and the degree to which they are differentiated from the fundamental tissue, he finds three different types of structure. Perhaps the most important correction of ideas previously accepted is his complete refutation of the statement found in so many text-books, that Monocotyledons have none but adventitious roots. Dr. Falkenberg asserts that the existence of a normal tap-root is general in Monocotyledons, with the exception of those that are altogether destitute of a root. The adventitious roots which subsequently, in many cases, supplant the original tap-root, do not differ from it in an anatomical point of view. A. W. B.

Jenkinson's Practical Guide to the Isle of Wight. By Henry Irwin Jenkinson, F.R.G.S., &c. Also Smaller Practical Guide. (London: Stanford, 1876.)

MR. JENKINSON, by his practical guides to the Lake District, Carlisle, and the Roman Wall, has already proved himself possessed of a rare faculty for the work of guide-book making. The handy volumes before us are quite equal to those previously published. The "Guide to the Isle of Wight" is evidently the result of conscientious work and minute painstaking; the author has gone over all the ground described, and made himself well acquainted with all the historical and antiquarian knowledge which adds interest to the various places referred to. The introduction to the larger "Guide," covering upwards of eighty pages, contains a *résumé* of the scientific knowledge which bears on the island—its geology, its flora, and its fauna. This part seems to us carefully and accurately compiled, and by the scientific visitor will be considered a valuable addition to the volume. Mr. Jenkinson divides the text of his "Guide" into six sections, grouped round the chief towns of the island, each section being accompanied by a full and clear and carefully executed map. Altogether Mr. Jenkinson's "Guide" is a thoroughly good, and we believe trustworthy, one; and while it deserves the title "practical," and will be of the greatest use to the visitor, the general reader might read it through with interest and profit.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

A Science Museum

THE fact that the Science and Art Department have had before them for at least ten years the proposal to establish a science museum, is shown conclusively enough in NATURE for last week. May I be allowed to draw attention to a still earlier suggestion of the same character? As far back as 1859, two years after the establishment of the Patent Office Museum, the Commissioners of Patents laid a Report before Parliament, in which the following passage occurs:—

"It is intended to make the Patent Office Museum an historical and educational institution for the benefit and instruction of the skilled workmen employed in the various factories of the kingdom, a class which largely contributes to the surplus fund of the Patent Office in fees paid upon patents granted for their valuable inventions. Exact models of machinery in subjects and series of subjects, showing the progressive steps of improvement in the machines for each branch of manufacture, are to be exhibited; for example, it is intended to show in series of exact models each important invention and improvement in steam propellers [steamboat propulsion] from the first engine that drove a boat of two tons burden to the gigantic machinery of the present day, propelling the first-rate ship of war or of commerce. The original small experimental engine that drove the boat of two tons burden, above referred to, is now in the museum, and is numbered one in the series of models of propellers."

Unhappily this brilliant project rested unfulfilled. "No. 1" of the series of models of steamboat propellers had but few followers, while other branches of mechanical science did not get so far as to have even a "No. 1." The conception was excellent, the execution lamentably deficient. Thus the collection which was to have expanded into a museum of mechanical and industrial science degenerated into an old lumber-room, and, instead of expanding over the ground originally allotted to it, contracted into its present dimensions.

Into the causes of this failure there is no need to enter. The thing has failed, and there is an end of it. Luckily there is a chance of something better now, and it is to be hoped that we shall soon have the collection belonging to the Patent Office divided into two parts—one part to be sent to the Science Museum, and the other to the nearest dust-heap. So long as it belongs to the Patent Office, the aggregation of rubbish will be sure to continue. The Commissioners have never exercised a power of selection, and any foolish invention, so that it is only the subject of a patent, has the right of *entrée*. Naturally it is not the important inventions which make their appearance at South Kensington. As part of a Patent Office, a museum is practically worthless. It is hardly possible to imagine an invention which—at least to an expert—cannot be as clearly explained by descriptions and drawings as by a model. For purposes of experiment and instruction models are obviously invaluable. By no other means, for instance, can *motion* be rendered intelligible to a class of students or a popular audience. When the object, however, is simply to define what an inventor has discovered or constructed, so that it can be understood by an expert, a drawing and a description are nearly always much better—always as good—as any model. The only reason why the Patent Office should have charge of such a museum is that the officials of the office are in constant communication with the particular class likely to contribute to the museum. Patent cases are fruitful in models, constructed, not for the engineers, but to enable the engineers to explain to those who have no special mechanical knowledge the action of the different apparatus before them. Many such models are of no public interest, but many are well worth preservation, and it was thought that from these and like sources the Patent Office Museum would soon grow rich. The event has hardly justified the hope, but that is no reason why, under better management, the promises held out fifteen years ago should not now be realised. With all its deficiencies, the Patent Office Museum has done one good service. It has preserved some quite invaluable examples of early mechanical science which would otherwise have been scattered to the four winds—most of them to the west wind and the States. These are ready to form the best possible foundation for the mechanical section of the Science Museum, a section